Santa Clara Valley Water District

Groundwater Conditions 75-76

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SANTA CLARA VALLEY WATER DISTRICT

GROUNDWATER CONDITIONS
ANNUAL REPORT

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Acknowledgment is hereby given to Randall Talley for his assistance in the preparation of this report.

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SUMMARY OF 1975-76
GROUNDWATER CONDITIONS

The volume of groundwater in storage decreased in Santa Clara County during the water year July 1, 1975 through June 30, 1976. With very low rainfall, 1975-76 ended showing large decreases of groundwater in storage of 70,000 acre-feet in the Santa Clara Valley Groundwater Basin, 12,000 acre-feet in the Coyote Groundwater Basin, and 62,000 acre-feet in the Llagas Groundwater Basin.

During this same period, the District imported 118,692 acre-feet of water through the South Bay Aqueduct. The Rinconada Water Treatment Plant treated 52,955 acre-feet of this water and the Penitencia Water Treatment Plant treated 13,130 acre-feet. The 20-mgd Penitencia Plant supplies treated water to the east side of North Santa Clara Valley.

No land surface subsidence was detected in 1975-76. Subsidence has been effectively halted since 1969 because groundwater levels have risen above and have remained above the critical pressure elevation.

Groundwater continues to be high-quality water usable for all beneficial purposes. However, certain localized areas have yielded groundwater of poor mineral quality. Inspection of groundwater chloride-concentration data indicates that the limits of saltwater contamination in most places have not changed significantly during the period 1949 through 1972.

INTRODUCTION

This is the annual report on groundwater conditions in the three major groundwater basins of Santa Clara County for water year 1975-76 which extends from July 1, 1975 to June 30, 1976. The purpose of this report is to inform the District Board of Directors and interested citizens of the current condition of the groundwater basins. The three major groundwater basins, which are interconnected and occupy nearly 30 percent of the total county area, are the Santa Clara Valley, Coyote and Llagas Basins, shown on Plate 1. Groundwater supplies nearly 49 percent of the total water used in the Santa Clara Valley Basin and almost all of that used in the Coyote and Llagas Basins. The remainder is supplied from local surface diversions and imported sources.

Zones of benefit have been established for the conservation, importation, treatment and distribution of water used in Santa Clara County and are shown on Plate 1.

Zone W-2 encompasses the Santa Clara Valley Groundwater Basin and was formed for the registration of those groundwater producing facilities that benefit from recharge of the groundwater basin by the District with local and imported water. In this zone, a charge is levied for groundwater extracted and the revenue thus derived is used to support the District's conservation and importation program. Major sources of water supply income are the groundwater charge levied in Zone W-2 and the sale of treated water. The groundwater charge for nonagricultural uses during 1975-76 was $30 an acre-foot, and for agricultural uses the groundwater charge was $8 an acre-foot. Treated water was sold at $65 an acre-foot, with water in excess of contracted amounts sold at $41 an acre-foot.

Zone W-4 encompasses all of Zone W-2 plus the lands of water consumers outside of Zone W-2 that use or otherwise benefit from locally conserved water and from the importation and distribution of water from the South Bay Aqueduct. In this zone, a property tax rate of $.018 per $100 of assessed valuation was levied to pay for the cost of water purchased to recover the accumulated overdraft in the groundwater basin, control land surface subsidence, and sustain an emergency supply of water.

In Zone W-3, comprising most of the Coyote Basin, an ad valorem tax of $.370 per $100 of assessed value (on land only) was levied in lieu of a groundwater charge. The subzones within Zone W-3 were formed for the purpose of assessing a groundwater charge on pumping facilities that export water from the Coyote Groundwater Basin to areas outside of Zone W-3. No groundwater charge was levied in the Llagas Basin.

HYDROLOGIC BALANCE

The rainfall in Santa Clara Valley for 1975-76 was the second lowest reported for the entire period of record. The San Jose station recorded 5.77 inches which averages 14.07 inches based on 102 years of record, and 7.27 inches were recorded at Gilroy which averages 19.9 inches.

All of the reservoirs, except for Vasona, which is maintained for recreation, continuously declined to the low levels indicated in Table 1. Inspection of Table 1, reveals that the reservoirs are drastically low compared to levels for the preceding year.

Each of the three groundwater basins experienced decreases in the volume of water in storage. As water levels rise and fall, the volume in storage changes. This change of stored water in the unconfined zone can be approximated by multiplying estimates of the storage capacity for the aquifer materials by the area and by the change in depth between groundwater levels at the beginning and end of the season (Plate 3). This year decreases of 64,500 acre-feet in the Santa Clara Valley Basin, 13,000 acre-feet in the Coyote Basin and 65,700 acre-feet in the Llagas Basin were computed.

These estimates were checked by balancing the hydrologic components of water supply and utilization. Water supply consists of precipitation, stream inflow, imported water and subsurface inflow. Water is utilized or lost by consumptive use, sewage export, stream outflow and subsurface outflow. The difference between supply and utilization is the net surplus or deficit of

TABLE 1 - RESERVOIR STORAGE ON JULY 1 '75 AND JULY 1 '76

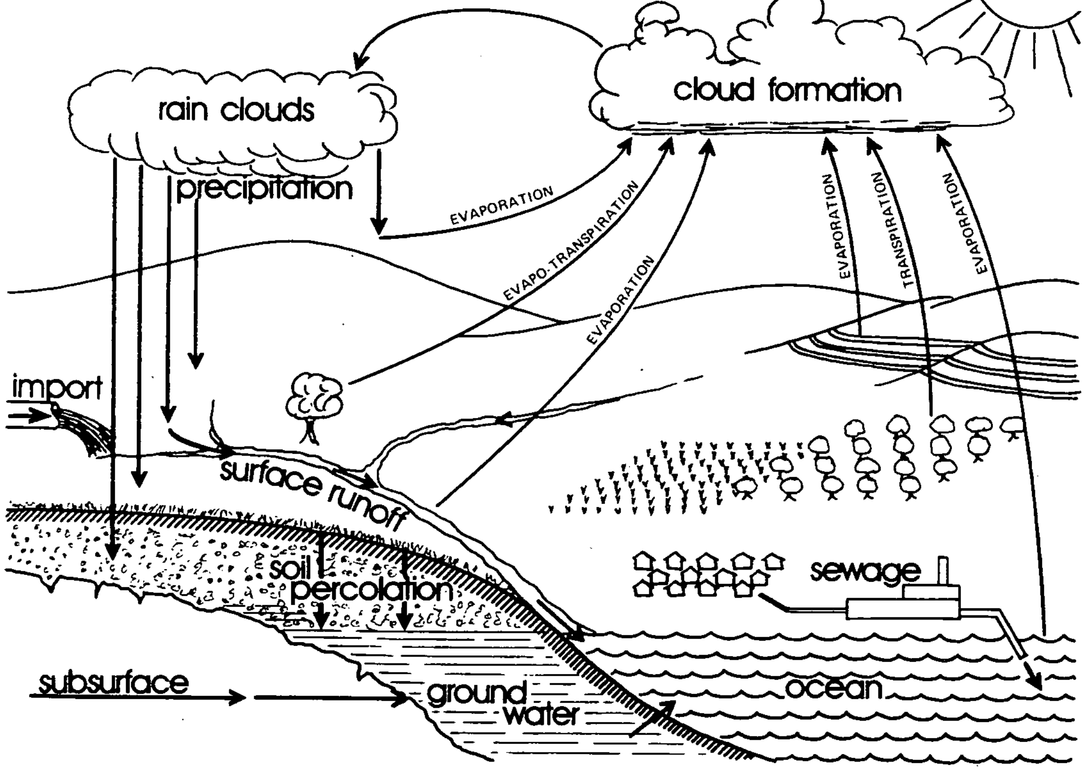
Reservoir	Capacity	Storage in Ac-Ft on July 1 '75	Percent Full	Storage in Ac-Ft on July 1 '76	Percent Full
Almaden	1,780	1,600	89.9	50	2.8
Anderson	91,280	83,860	91.6	49,200	53.9
Calero	10,160	8,300	81.7	3,450	40.0
Chesbro	8,086	7,100	87.8	1,450	17.9
Coyote	23,700	22,900	96.6	10,300	43.5
Guadalupe	3,740	2,880	77.0	100	2.7
Lexington	20,210	8,900	44.0	1,000	5.0
Pacheco	6,135	4,400	71.7	250	4.1
Stevens Creek	3,600	2,800	77.8	140	3.9
Uvas	10,000	8,050	80.5	500	5.0
Vasona	410	364	88.8	396	96.6
		150,894		66,836	

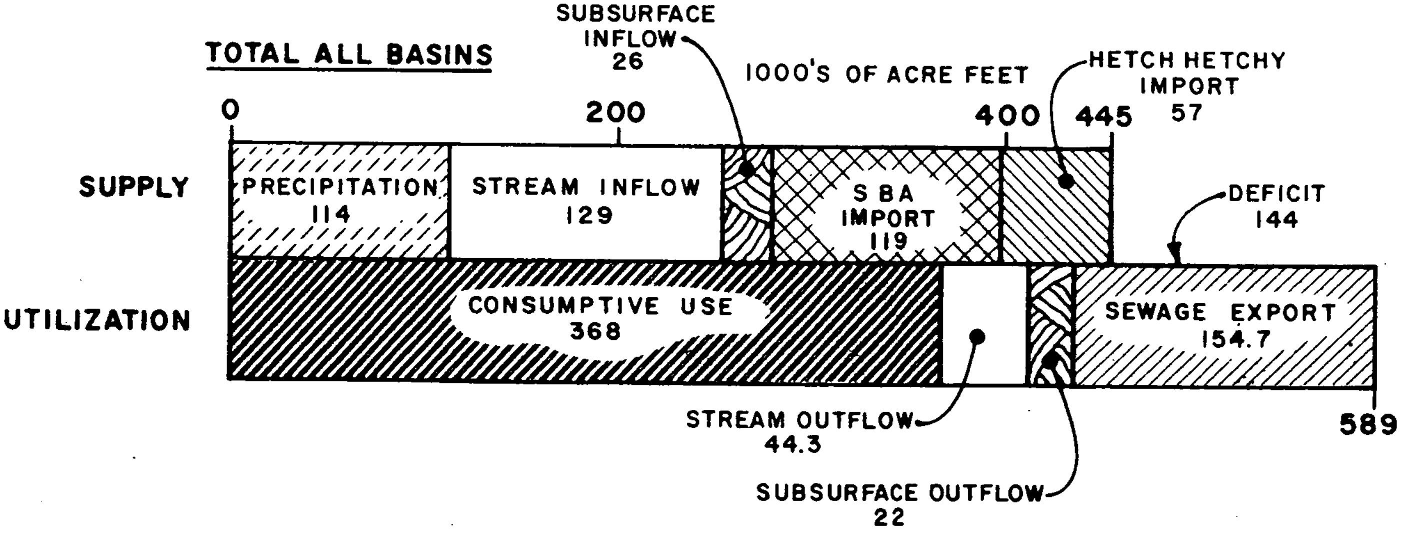
Table 1

water in storage in the groundwater reservoirs at the end of the season. The hydrologic balance, illustrated in Figure 1, shows that the decrease in the Santa Clara Valley Basin was 70,000 acre-feet, the decrease in the Coyote Basin was 12,000 acre-feet, the decrease in the Llagas Basin was 62,000 acre-feet (these compare favorably to the previously obtained deficiences of 64,500; 13,000 and 65,700 acre-feet, respectively).

The discrepancy observed between the storage changes obtained as a net balance of hydrologic components and that obtained as a product of change in water levels and storage capacity is the result of uncertainties involved in the estimation of subsurface inflows, consumptive use and the storage coefficient of aquifers. However, the results are well within the accuracy acceptable for this kind of computation.

the hydrologic cycle





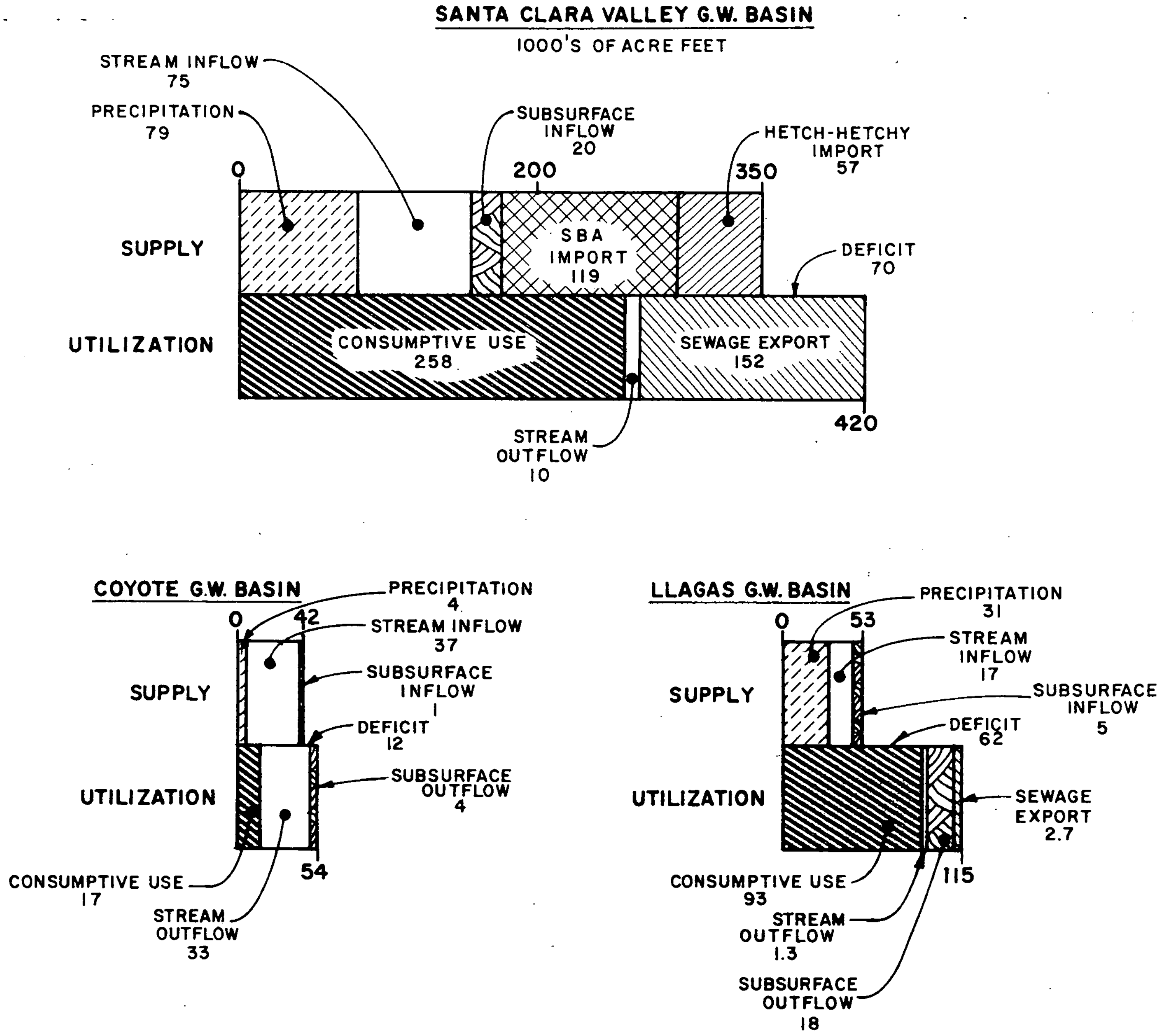


FIGURE I. HYDROLOGIC BALANCE OF GROUND WATER 1975-76
(VALUES IN 1000'S ACRE FEET)

GROUNDWATER LEVELS

A groundwater contour map, showing lines of equal elevation of water levels in wells as of September 1, 1976 (traditionally the seasonal low), is shown on Plate 2. Plate 3 shows lines of equal change in elevation of water in wells between June 1, 1975 and June 1, 1976. Plate 4 shows lines of equal depth to water as of September 1, 1976. These groundwater contours are based on information from more than 200 wells.

The monthly fluctuation of water levels from 1970 to 1976 in the Santa Clara Valley, Coyote, and Llagas Basins are presented in Figure 2. These levels represent the weighted average of depths to water in approximately 35 representative wells in both the confined and unconfined zones which are monitored at the beginning of each month. The average water level in the Santa Clara Valley Basin declined 10 feet below 1975 levels, while water levels in the Coyote and Llagas Basins dropped an average of 12 and 33 feet, respectively. The rise or fall is measured at the low points from year to year which occurs at the end of the pumping season. This year because of the very low rainfall, all three basins showed net declines in groundwater levels between September 1975 and September 1976.

In Figures 3 and 4, the historical depths to water are shown, in conjunction with rainfall and population, for the Santa Clara Valley and Llagas Groundwater Basins.

The dependence of water levels on seasonal rainfall is best illustrated in the Llagas Groundwater Basin. This Basin is much

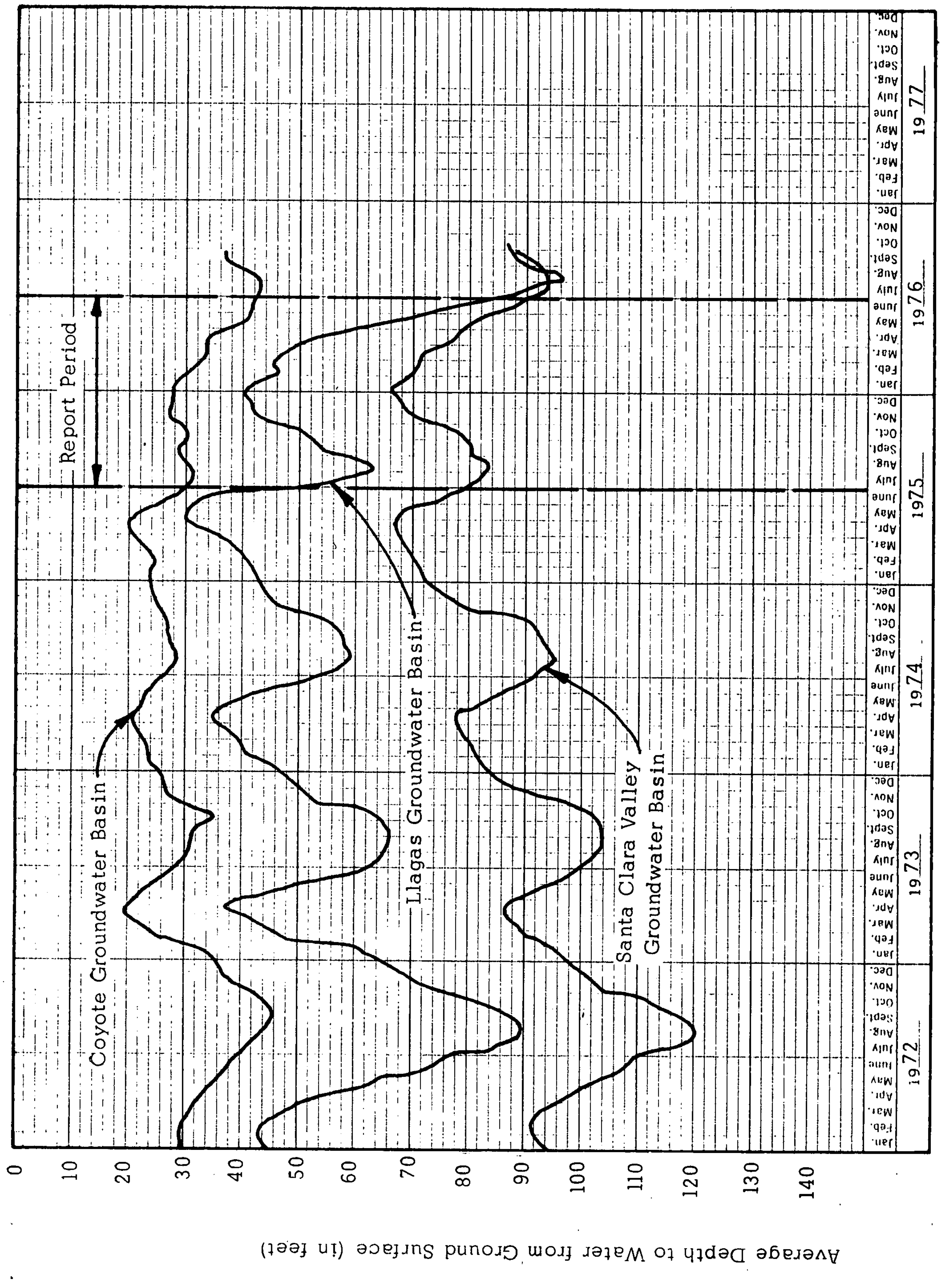


Figure 2. Fluctuations of Average Water Level

smaller than the Santa Clara Valley Groundwater Basin and has a lower storage capability per unit volume. Water levels are, therefore, more responsive to the amounts of rainfall and extraction in the Llagas Basin.

The north valley basin does not have large rapid seasonal fluctuations in water levels because of its capacity and because additional imported water supplies are available to the North County. These additional supplies reduce the draft on the groundwater basin. It is possible to carry over from year to year quantities of water stored in the larger local surface water reservoirs to be used for groundwater recharge, and to use water imported from the South Bay Aqueduct for recharge when local supplies are low.

The District is continuing its program of recharge of the Santa Clara Valley Groundwater Basin with local and imported water. On the average, more than 100,000 acre-feet per year are recharged through District facilities.

In 1975-76, almost 110,000 acre-feet was recharged in North County. Since there was little runoff from rainfall, this was only possible by using water which was left over from previous years in the District's reservoirs and importing substantial amounts of additional water from the South Bay Aqueduct.

Approximately 57,000 acre-feet of water was recharged from existing supplies in the reservoirs and approximately 53,000 acre-feet was recharged from imported South Bay Aqueduct water. Additionally, 8,300 acre-feet of water was recharged in South County

FIGURE 3

SANTA CLARA VALLEY BASIN

LAND SUBSIDENCE–
Elevation of U.S. Coast and Geodetic Survey Benchmark P7 in San Jose

POPULATION—
Total Population of Santa Clara County

DEPTH TO WATER –
Average Depth to Water in Feet, in Wells in Santa Clara Valley Groundwater Basin at End of Irrigation Season

RAINFALL—
Total Seasonal Rainfall at U.S. Weather Bureau Station in San Jose

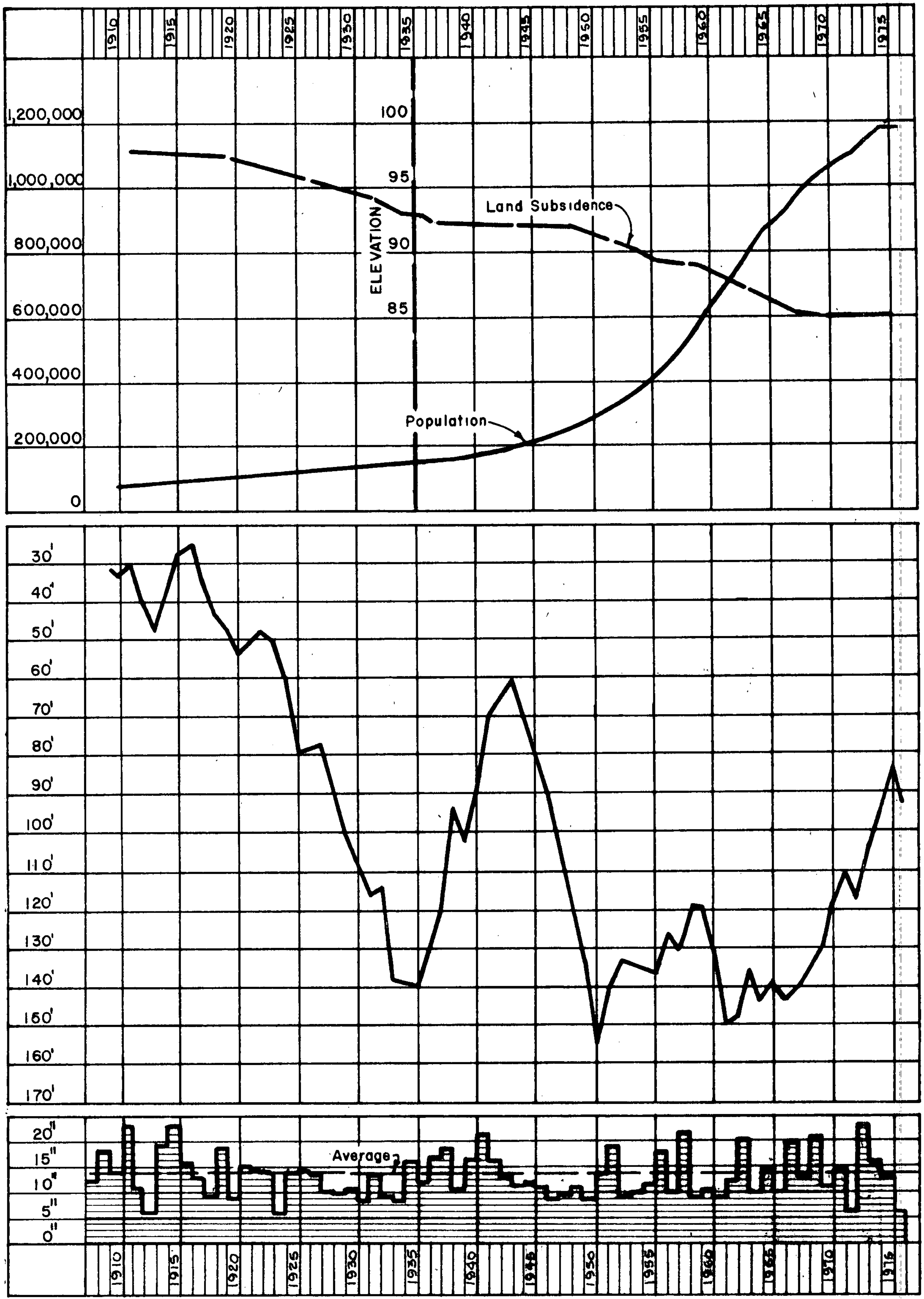

1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
100
95
90
85
ELEVATION
Land Subsidence
Population
30'
40'
50'
60'
70'
80'
90'
100'
110'
120'
130'
140'
150'
160'
170'
20"
15"
10"
5"
0"
Average
1976

Figure 3

FIGURE 4

L L A G A S B A S I N

POPULATION—
Combined Populations of the Cities of Morgan Hill and Gilroy

DEPTH TO WATER—
Average Depth to Water in Feet in Wells in Llagas Groundwater Basin at End of Irrigation Season

RAINFALL—
Total Seasonal Rainfall at U.S. Weather Bureau Station in Gilroy

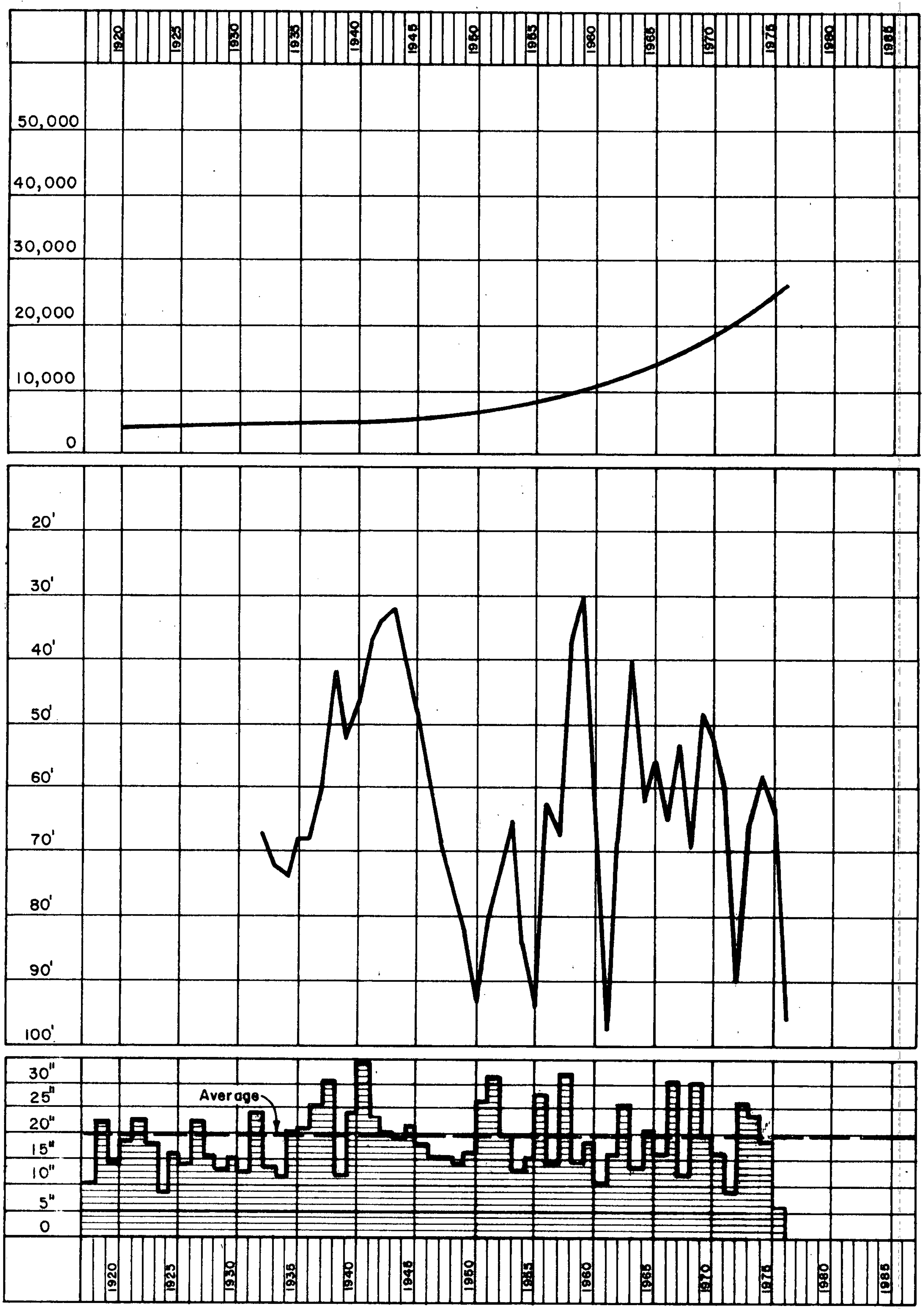

1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
50,000
40,000
30,000
20,000
10,000
0
20'
30'
40'
50'
60'
70'
80'
90'
100'
30"
25"
20"
15"
10"
5"
0
Average

Figure 4

LAND SURFACE SUBSIDENCE

Subsidence of the land surface occurs when intensive groundwater pumping results in lowered artesian pressures in areas of groundwater confinement. This increases the effective overburden load on the clay materials within the confined aquifers causing them to compact, with consequential sinking of the land surface. This relationship between artesian head decline and land surface subsidence is graphically represented in Figure 3 which illustrates the historical occurrence of subsidence and the corresponding average depths to water.

Subsidence has cost Santa Clara County residents millions of dollars because of its direct effect on the design of and damage to flood control channels, levees, wells, sanitary sewer lines and other underground utilities.

Subsidence in the Santa Clara Valley is a condition carefully watched by the District, who annually makes a survey of ground surface elevations across the Valley floor around the southern end of San Francisco Bay to check for subsidence. The survey for 1976 showed no change in elevation of the Valley floor from that in 1975. Land surface subsidence has not occurred since 1969 because groundwater levels have risen above and have remained above the critical pressure elevation.

The District has been working toward the goal of obtaining water supplies adequate to stop the overdraft of groundwater and to raise the artesian head. As a result of increased imported water supplies, average rainfall, increased artificial recharge, and decreased pumping, the recovery of groundwater levels since 1966 has been dramatic. Continued halting of subsidence is directly dependent on maintaining groundwater levels above those prevailing in 1969.

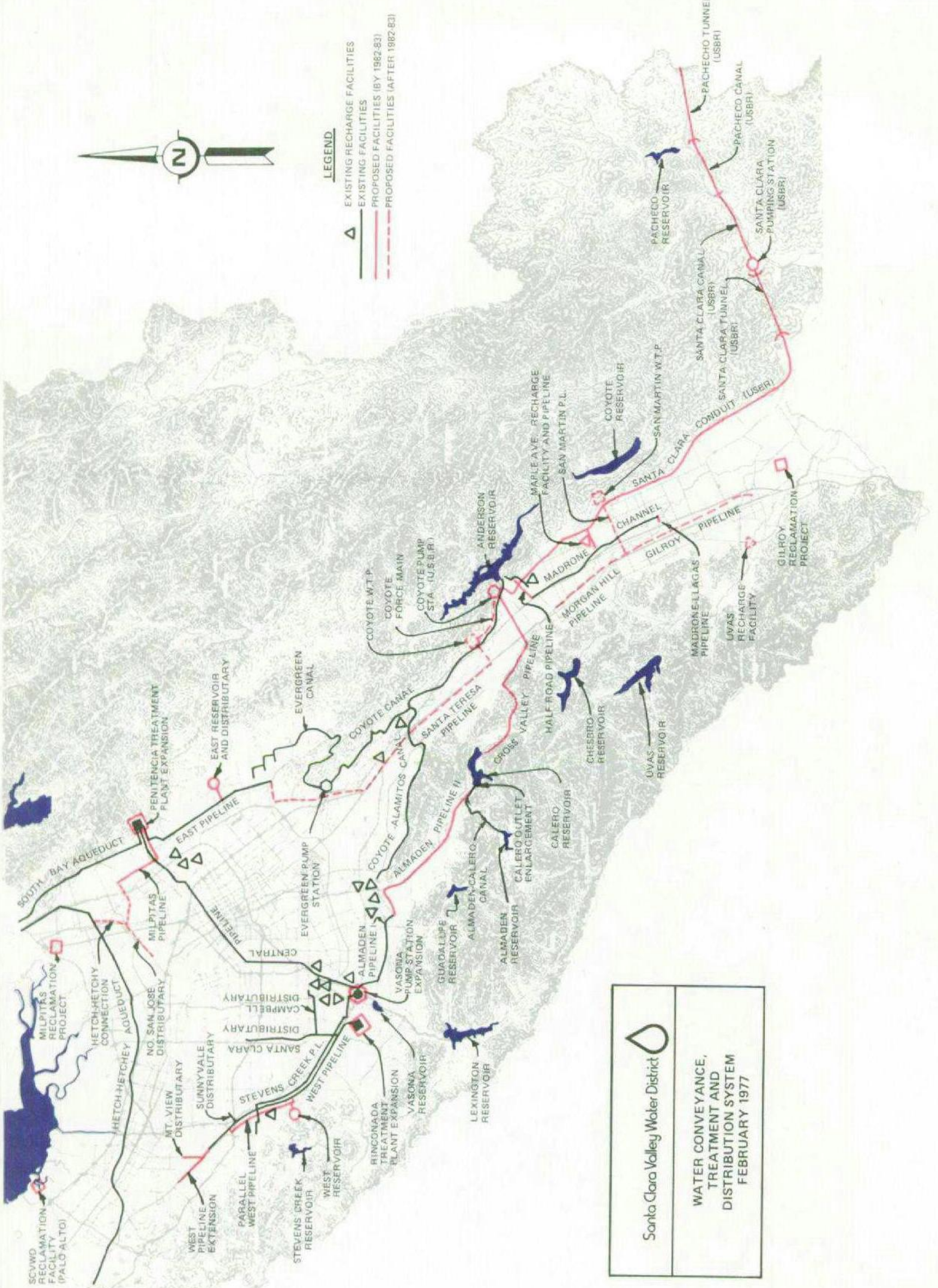
IMPORTED WATER

The primary source of imported water for Santa Clara County is the South Bay Aqueduct. During the 1975-76 water year, 118,692 acre-feet of water was delivered into Santa Clara County through the South Bay Aqueduct. Of this total, 52,948 acre-feet was treated at the Rinconada Water Treatment Plant and 13,127 acre-feet was treated at the Penitencia Water Treatment Plant for delivery to consumers through retail water agencies. In addition, 808 acre-feet of raw water was delivered directly from District pipelines for use by individual contractors. The remaining 51,809 acre-feet was percolated into the underground through the District's recharge facilities.

For the calendar year 1976, the District is obligated by contract to purchase its entitlement of 88,000 acre-feet from the State.

A second source of imported water comes from the Sierras via the San Francisco Water Department's Hetch Hetchy Aqueduct. During the water year 1975-76, this system delivered 56,837 acre-feet directly to the water supply systems of the cities of Milpitas, San Jose, Sunnyvale, Santa Clara, Mountain View and Palo Alto and to the Purissima Hills County Water District. Small amounts of this water were also delivered to Stanford University, NASA, Moffett Field, Agnews State Hospital and other local contractors.

The existing and proposed water conveyance, treatment and distribution system for the Santa Clara Valley is shown in Figure 5.



Santa Clara Valley Water District

WATER CONVEYANCE, TREATMENT AND DISTRIBUTION SYSTEM FEBRUARY 1977

Figure 5

LOCALLY DEVELOPED WATER SUPPLIES

Rainfall is the source of all locally developed water supplies. The long-term precipitation at San Jose is illustrated in Figure 6 as the accumulated departure from the mean which denotes graphically the wet and dry periods of rainfall. The important feature in Figure 6 is the slope of the curve; particularly whether it is positive (up) or negative (down). Each point is plotted as a difference from the long-term averages; a wet year showing a positive difference and a dry or below normal rainfall year indicating a negative difference. If each difference is added to that of the previous year, a trend of positive or negative increments becomes apparent. An upward trend would, therefore, indicate a period of years which have received above normal rainfall and a downward trend would be indicative of a drought period.

The accumulated departure from the mean is used to identify long-term wet and dry periods. Despite short-term fluctuations, the long-term periods are evident in Figure 6 .

Beginning in 1875 rainfall approximated the long-term average until 1890 when a series of wet years began which generally continued through about 1916. The valley experienced low rainfall for several years following 1920 until 1935. It was during this drought period that valley residents first initiated a comprehensive water conservation program. The completion of the valley's first five water supply reservoirs in 1935 coincided with a short interval of above-average rainfall. This enhanced the water supply picture and enabled groundwater levels, which had been declining, to recover. There is a remarkable correlation between the depth-to-water in Figure 3 and the accumulated departure from the average rainfall in Figure 6.

Between 1943 and 1962, another series of dry years occurred. Since 1962, the valley has had rainfall slightly above the long-term average.

The demand for water and the amount of water available for supply are both very dependent on seasonal rainfall. In a below normal rainfall year when water supplies are low, the demand for municipal, industrial and agricultural water increases, while in a wet year, water demand drops. Shown on Figure 7 are the water demand projections for the period 1970 to 2020 and the recorded water use through 1976. The projections are based on the assumption of average seasonal rainfall. Estimates of the seasonal groundwater extractions through 1977 for each of the three basins are shown in Table 2. Actual water production in the North County for 1970-76 from all sources of supply is summarized in Table 3 and illustrated on Figure 8.

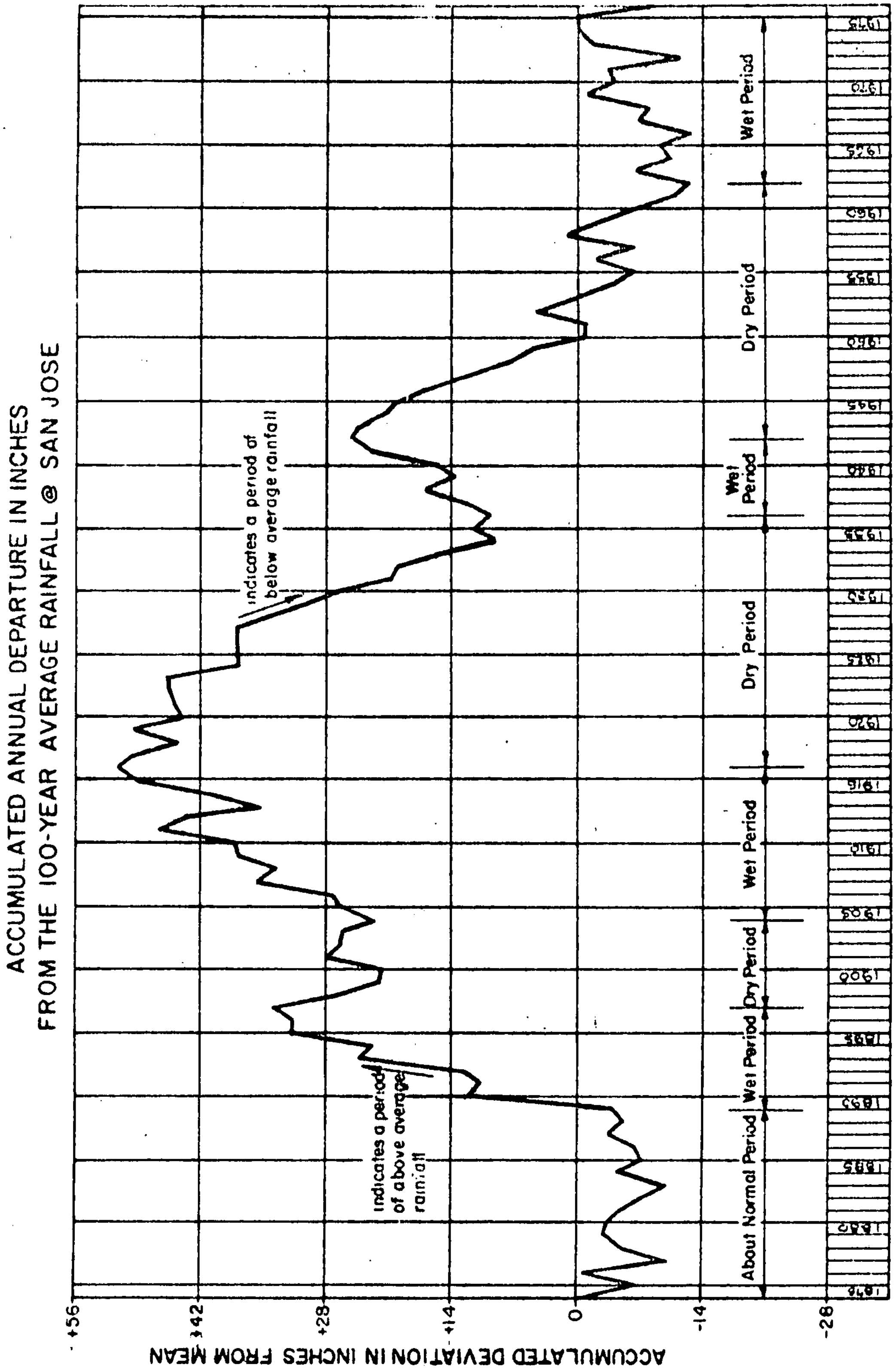
ACCUMULATED ANNUAL DEPARTURE IN INCHES
FROM THE 100-YEAR AVERAGE RAINFALL @ SAN JOSE
ACCUMULATED DEVIATION IN INCHES FROM MEAN
+56
+42
+28
+14
0
-14
-28
1876
1880
1885
1890
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
About Normal Period
Wet Period
Dry Period
Wet Period
Dry Period
Wet Period
Dry Period
Wet Period
Indicates a period of above average rainfall
Indicates a period of below average rainfall

Figure 6

PROJECTED WATER DEMAND AND ACTUAL WATER PRODUCTION

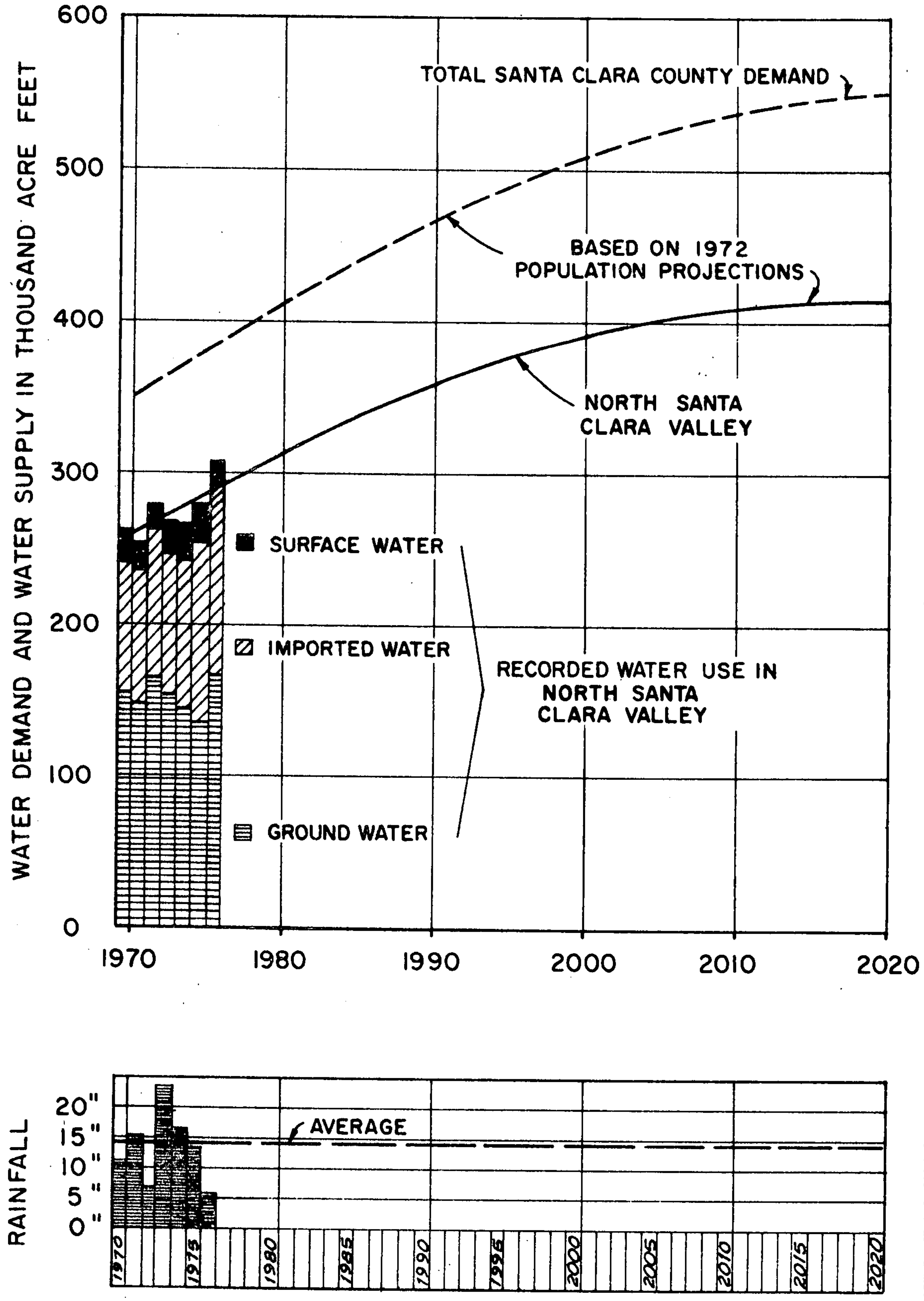


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FIGURE 7

TABLE 2

ESTIMATED SEASONAL GROUNDWATER EXTRACTIONS
(VALUES IN ACRE-FEET)
ASSUMING AVERAGE RAINFALL

	Groundwater Basin			
Water Year and Use	Santa Clara Valley	Coyote	Llagas	Total
1975-76				
Agric. Use	20,000*	10,000	62,000	92,000
Urban Use	148,500*	500	10,000	159,000
Total	168,500*	10,500	72,000	251,000
1976-77				
Agric. Use	17,200	11,500	65,700	94,400
Urban Use	124,400	500	10,700	135,200
Total	141,200	12,000	76,400	229,600
1977-78				
Agric. Use	17,400	12,000	67,500	96,900
Urban Use	126,000	500	11,000	137,500
Total	143,400	12,500	78,500	234,400

*These are the recorded extractions.

TABLE 3

WATER USE SUMMARY

Santa Clara Valley Groundwater Basin

(values in acre-feet)*

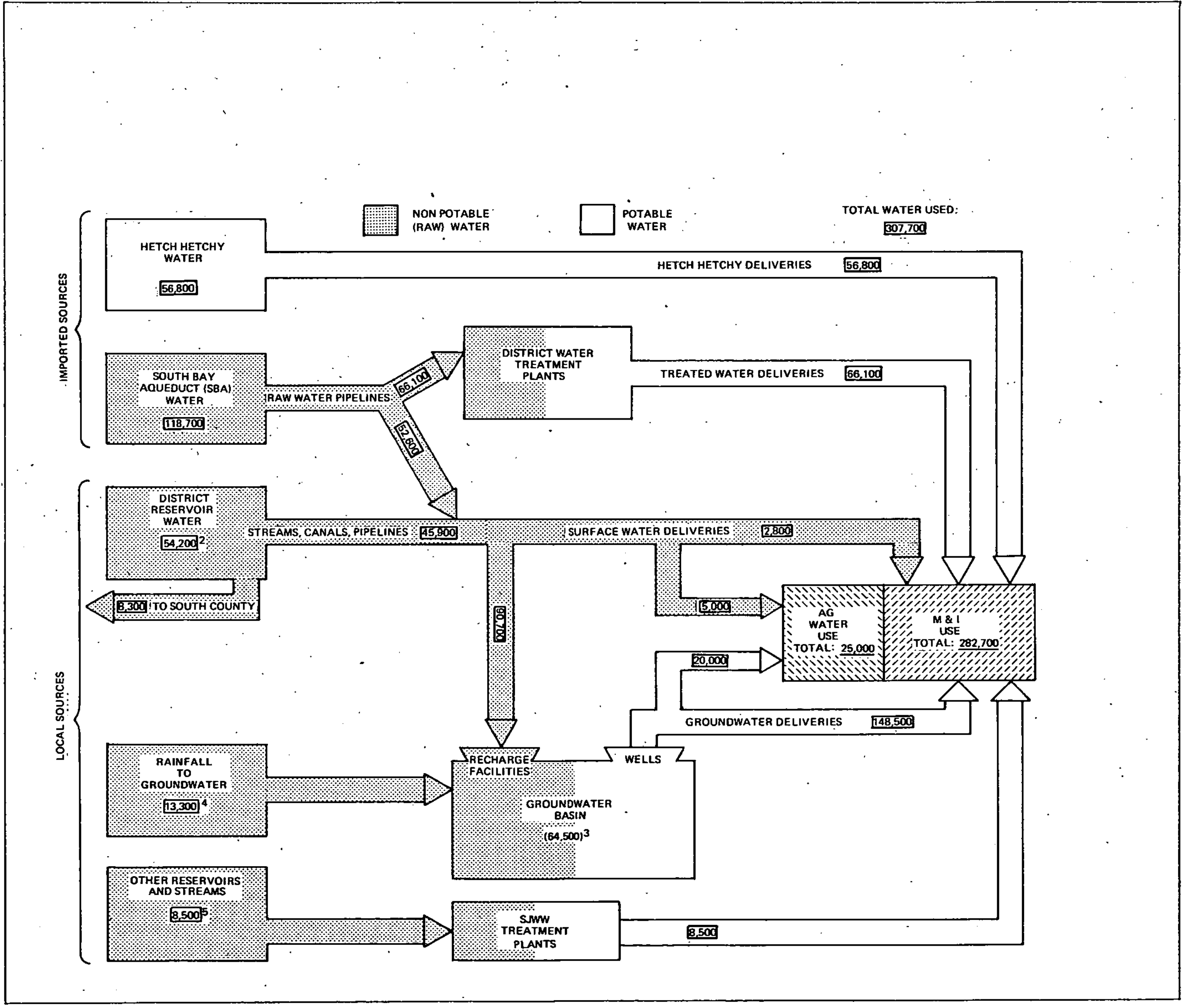
Fiscal Year	Surface Water		Groundwater		SBA Import**				
	Ag	Non-Ag	Ag	Non-ag	Treated	Contracted Untreated	Hetch Hetchy	SJWW Diversion	Total
69-70	4900	800	29300	125100	39200	500	48300	15800	263,900
70-71	4400	1100	23700	124300	44000	700	45200	12900	256,300
71-72	4800	1500	24000	142200	48800	800	49900	8800	280,700
72-73	4200	1600	17500	137800	45000	600	48900	14600	270,200
73-74	3000	1800	15900	129000	45500	600	52200	20800	268,700
74-75	3500	1900	16900	120400	67400	600	53400	17500	281,600
75-76	5000	2000	20000	148500	66100	800	56800	8500	307,700

* Numbers rounded to nearest 100 acre-feet.

** SBA Imported Water recharged to the groundwater basin included in groundwater used.

WATER SUPPLY AND USE
NORTH SANTA CLARA COUNTY
1975-76

(ALL VALUES IN ACRE FEET)[1]


NON POTABLE (RAW) WATER
POTABLE WATER
TOTAL WATER USED: 307,700
IMPORTED SOURCES
HETCH HETCHY WATER 56,800
HETCH HETCHY DELIVERIES 56,800
SOUTH BAY AQUEDUCT (SBA) WATER 118,700
RAW WATER PIPELINES
66,100
52,600
DISTRICT WATER TREATMENT PLANTS
TREATED WATER DELIVERIES 66,100
LOCAL SOURCES
DISTRICT RESERVOIR WATER 54,200[2]
STREAMS, CANALS, PIPELINES 45,900
SURFACE WATER DELIVERIES 2,800
8,300 TO SOUTH COUNTY
90,700
5,000
20,000
AG WATER USE TOTAL: 25,000
M & I USE TOTAL: 282,700
GROUNDWATER DELIVERIES 148,500
RECHARGE FACILITIES
WELLS
GROUNDWATER BASIN (64,500)[3]
RAINFALL TO GROUNDWATER 13,300[4]
OTHER RESERVOIRS AND STREAMS 8,500[5]
SJWW TREATMENT PLANTS
8,500

1. Water quantities rounded to the nearest 100 acre feet.
2. Includes 2,800 acre feet of reservoir inflow and 51,400 acre feet withdrawn from water in storage from previous years.
3. Withdrawn from groundwater storage resulting in an average 10 foot drop in groundwater levels.
4. Includes an estimated 10,000 acre feet of unmeasurable subsurface inflow.
5. From previous year's storage.

Figure 8

WATER QUALITY

Surface waters of the Santa Clara Valley are generally of excellent mineral quality, characterized by relatively low concentrations of dissolved solids, low percent sodium, and, with some exceptions in the Penitencia area, low boron content.

Groundwater pumped from most of the existing wells in the County's basins is of good quality and, in general, meets all requirements for drinking water as set forth in the Standards of the U.S. Public Health Services. Groundwaters from properly constructed and protected wells, including many municipal well fields, are in some places used directly without chlorination.

Graphical representations of some significant water quality parameters at selected wells are shown in Figure 9. The locations of these wells are shown on Plate 1. Generally, the pumped water may be classified as moderately to extremely hard. Hardness of water is caused principally by compounds of calcium and magnesium.

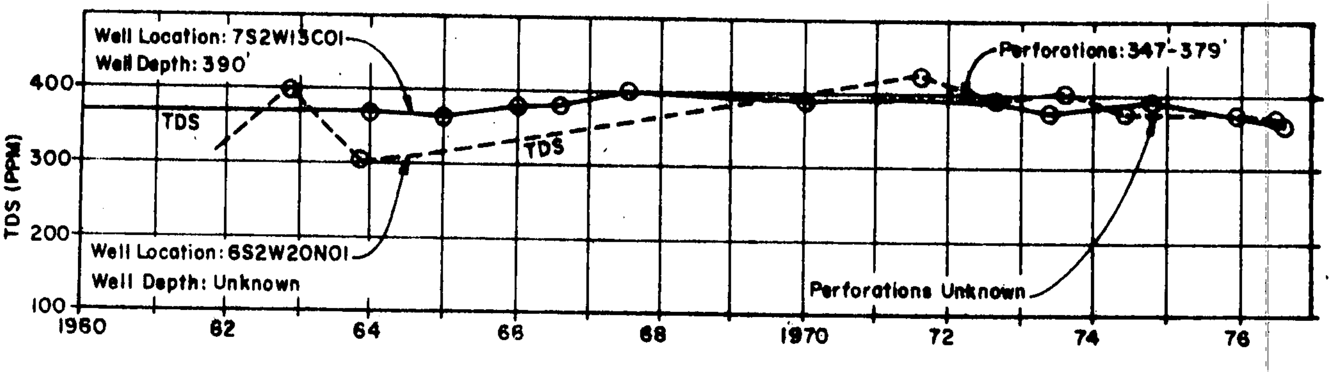
Certain localized areas have yielded groundwater of poor quality. Groundwater is subject to contamination in areas of intensive land use. The principal surface sources of contamination are septic tanks, surface ponding of contaminants and pollutants, and questionable waste disposal practices. From subsurface sources, the threat of degradation comes from saltwater intrusion from San Franscisco Bay (Plate 5) or from mineralized connate waters found at depth.

Another factor which may contribute to the degradation of the groundwater is the method of well construction. Properly constructed wells eliminate the possibility of the well functioning as a channel for the movement of water between contaminated (or degraded) and uncontaminated aquifers and also prevent contamination from surface sources. Improper methods of well construction and destruction, if allowed, could contribute to the deterioration of freshwater aquifers. Once an aquifer becomes contaminated or degraded, its restoration is extremely difficult and expensive. In order to help prevent degradation of the groundwater in Santa Clara County, the District has adopted well construction and destruction standards (SCVWD Ordinance No. 75-6). The purpose of these standards is to protect and preserve the groundwater supply for future uses.

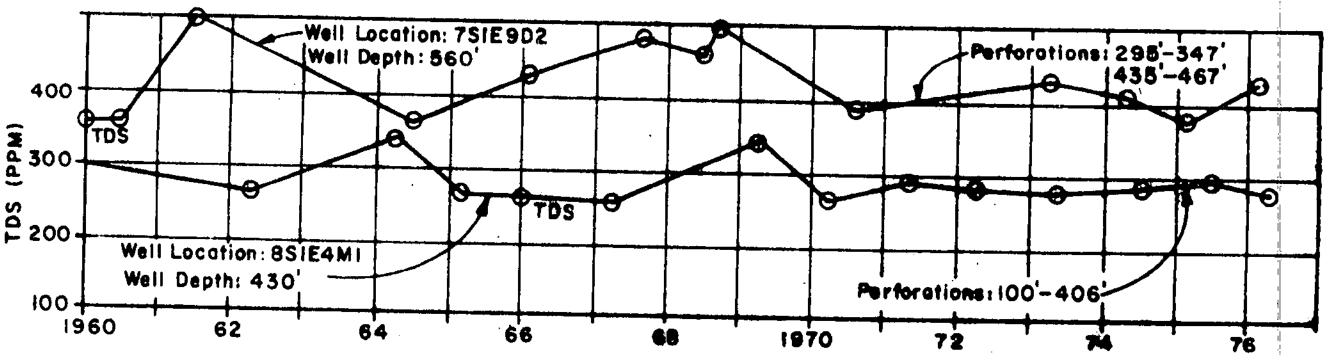
To aid in the management and protection of the quality of all the waters in the valley, the District has initiated a joint water quality program with the Department of Water Resources and the U. S. Geological Survey. The objective of the program is to develop a comprehensive plan for monitoring the quality of waters in the underground basins, streams, and the surface reservoirs.

In a related study the Department of Water Resources is cooperating with the District in a limnological investigation of Anderson Reservoir. Limnology is the study of physical, chemical, and biological conditions of a freshwater body and its tributary streams and watershed. Upon completion of the Anderson Reservoir investigation, other reservoirs may be studied. The product of these investigations will be a collection of adequate baseline water quality data for each reservoir. This information is a valuable tool for identifying sources of contamination and setting reservoir operation criteria. Indications of trends brought out through regular monitoring will make it possible to predict the impact of projected land use changes.

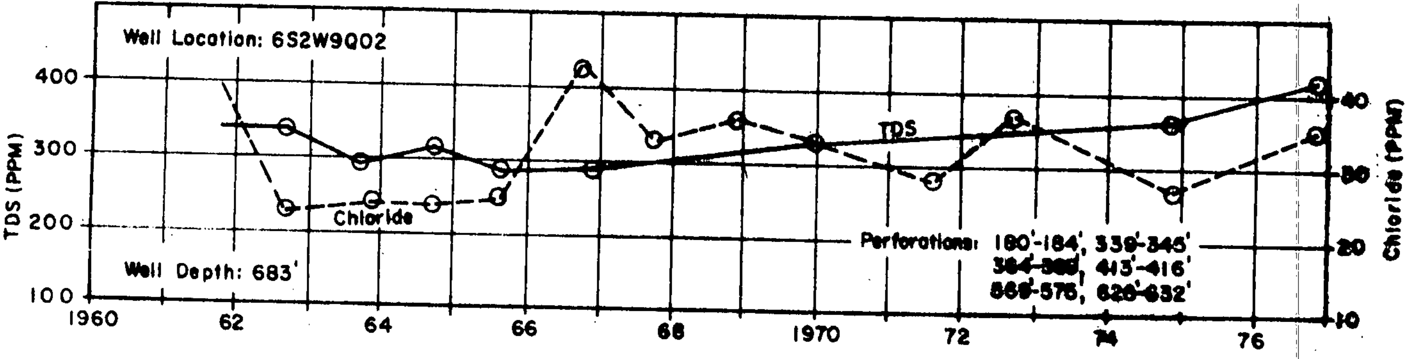
GROUNDWATER QUALITY VARIATIONS SANTA CLARA VALLEY AND LLAGAS GROUNDWATER BASINS



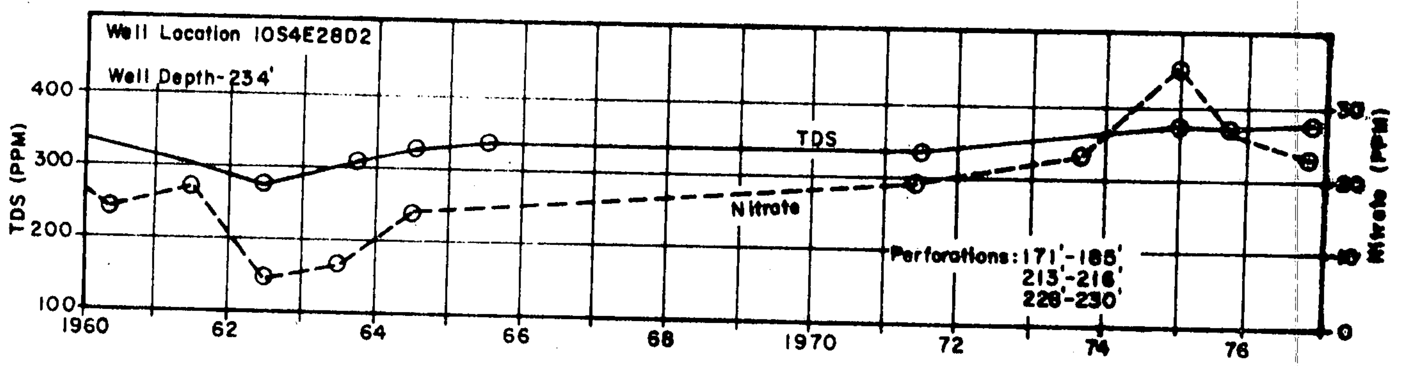
Temporal Variation of TDS - Santa Clara Valley Groundwater Basin



Temporal Variation of TDS - Santa Clara Valley Groundwater Basin



Temporal Variation of TDS and Chloride - Santa Clara Valley Groundwater Basin



Temporal Variations of TDS and Nitrates - Llagas Groundwater Basin

FIGURE 9

SALTWATER CONTAMINATION

Along the margins of South San Francisco Bay are shallow aquifers (less than 150 feet deep), which contain saltwater contaminated water. These aquifers and the poor quality water they contain are important to water management within the County because they overlie the deep artesian aquifers which are a major source of water supply to the County. Therefore, the delineation of areas where the shallow groundwater is of inferior quality is an aid in assessing potential hazards to the deep aquifers and in planning for their protection against contamination.

The District contracted with Arthur J. Inerfield and Associates, Consulting Engineers, to study and report on the extent of the shallow aquifer contamination. Their report titled "Review of Shallow Groundwater Zone Salinity Monitoring Program" was completed in February 1976 and is abstracted in the following paragraphs.

The chloride content of local uncontaminated, shallow groundwater normally ranges between about 40 and 60 mg/l. When levels of mineralization are found to be substantially greater, it can be reasonably assumed that some special contaminating influence is involved. A chloride index level of 100 mg/l was adopted to define areas which have been subjected to noticeable alteration of quality. Plate 5 delineates the gross areas within which maximum shallow zone chloride concentrations of 100, 500, 1000 and 2000 mg/l have been found.

The distribution pattern of excessive chloride occurrence shows a bay-related origin for shallow zone contamination.

Several possible contamination processes are suggested by these patterns. Although the available data does not allow a conclusive analysis, there is a reasonable basis for preliminary and tentative concepts pending further investigation. These are discussed below.

Given the ready availability of saline waters, intrusion can be induced by the severe lowering of the shallow aquifer piezometric level by heavy well pumping as has occurred in the Niles Cone area in Fremont. Historical records show that in most places the shallow aquifers in Santa Clara County have not recently been subjected to comparable heavy pumping development and overdraft. Consequently, there is no evidence that there was a long-term piezometric lowering sufficient to create and sustain steep landward flow gradients from the Bay. The mechanism of saline intrusion of shallow aquifers in the classical sense, as found in the Fremont area, does not appear to account for all of the shallow zone contamination in Santa Clara County. However, many fringe areas immediately adjacent to the bay water have definitely been intruded in this manner.

The incursion of tidal waters inland along watercourses appear to affect near surface semi-perched aquifers in adjacent areas. Inland incursion of tidal waters has increased markedly along most watercourses. Land surface subsidence has been chiefly responsible for this by lowering channel grades.

The stream most affected by channel lowering and increased tidal incursion is Guadalupe River, due to its location in areas of greatest subsidence and to channel improvements which have lowered the channel bottom. Whatever the actual extent of channel lowering, it has obviously been substantial. This has allowed tidal effects to reach several miles farther inland along Guadalupe River than was previously possible. This appears to be reflected by the southerly prolongation of shallow groundwater contamination delineated in Plate 5.

In the vicinity of the Palo Alto baylands, it is suspected that saltwater contamination has resulted from the classical intrusion from the bay waters. To reduce this intrusion and protect the aquifer, the District has undertaken the design of a system which will inject water into the shallow aquifers through wells. The injected water will set up a hydraulic barrier against intrusion.

The water for injection will be furnished by a 3 MGD Water Reclamation Plant which will provide advanced treatment of effluent from the Palo Alto Regional Water Quality Control Plant.

A key part of the implementation of the reclaimed water well injection program will be the instituting of a comprehensive monitoring program with special emphasis upon public health aspects. The aquifer into which reclaimed water is to be injected is not currently used for a public water supply. Thus, the project has the unique possibilities of helping to prevent contamination of good quality groundwater while at the same time providing the basis for research into the possible utilization of reclaimed water to augment other sources of supply in order to satisfy future water needs.

GLOSSARY

Aquifer - A geologic formation that stores, transmits, and yields significant quantities of water to wells and springs.

Artesian Well - A well tapping a confined aquifer in which the static water level stands above the top of the aquifer. If the water level rises above ground level, the well would be a flowing artesian well.

Consumptive Use - Water consumed by vegetative growth in transpiration and building of plant tissue, and water evaporated from adjacent soil, from water surfaces, and from foliage. Also, water similarly consumed and evaporated by urban and nonvegetative types of land use.

Contamination - Any introduction into water of microorganisms, chemicals, wastes or wastewater in a concentration that makes the water unfit for its intended use.

Dry Period - An historic period of years when water supply is much below normal. An example was 1929-34 when the water in northern California streams averaged only about 38 percent of normal. It has been used as the reference drought situation in much water resource planning.

Hydrology - The origin, distribution, and circulation of waters of the earth - precipitation, streamflow, infiltration, groundwater storage, and evaporation.

Hydrology, Groundwater - The branch of hydrology that deals with groundwater, its occurrence, movement, replenishment, and depletion.

Infiltration - The movement of water through the soil surface and into the soil.

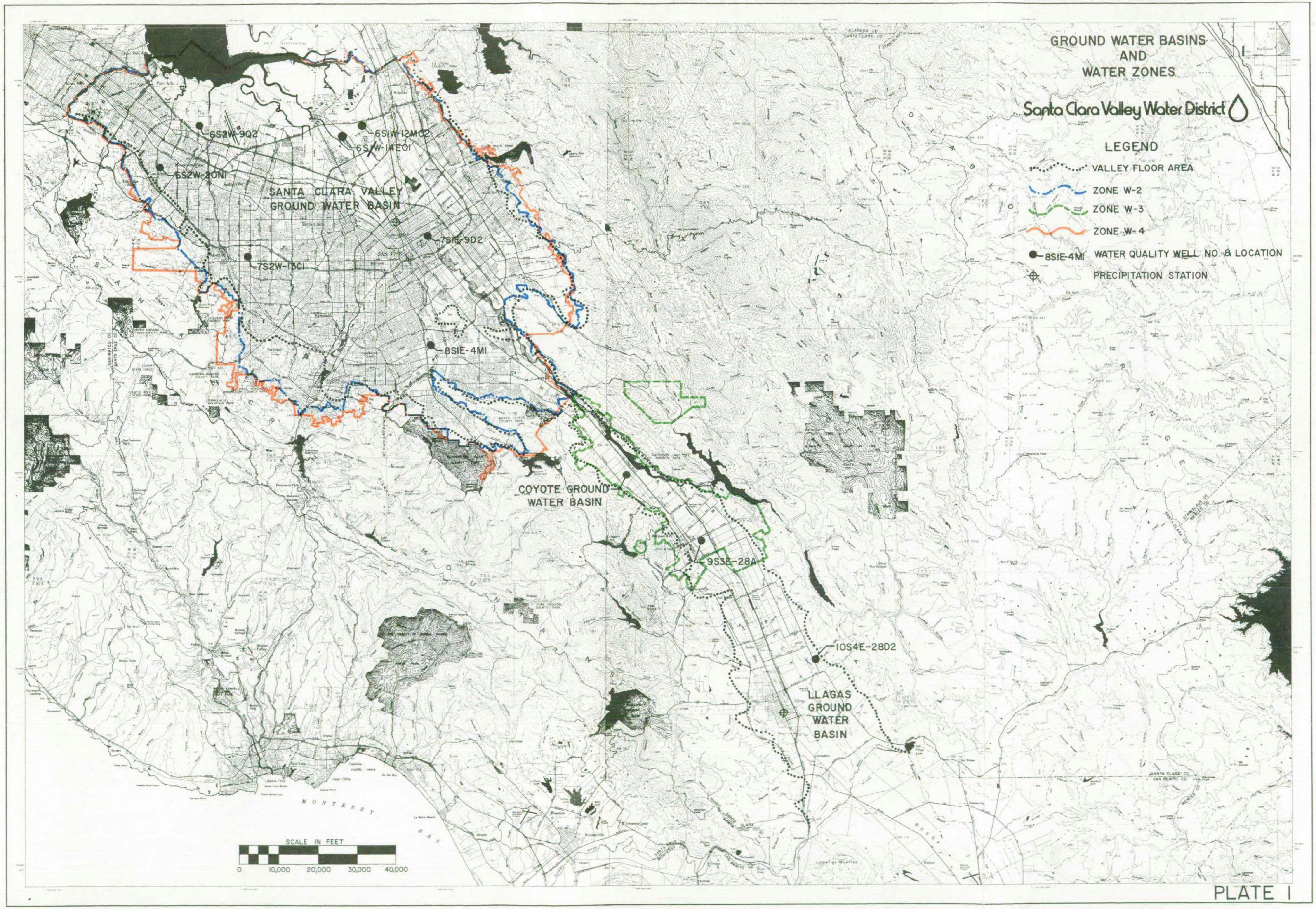
Injection Well - Well used for introduction water into an aquifer. Technique used to stop seawater intrusion, replenish an aquifer, or dispose of cooling water.

Overdraft - The condition in a groundwater basin where the amount of water withdrawn by pumping exceeds the amount of water replenishing the basin over a long time period.

Percolation - The slow movement of water through the soil or alluvium to and beneath the groundwater table.

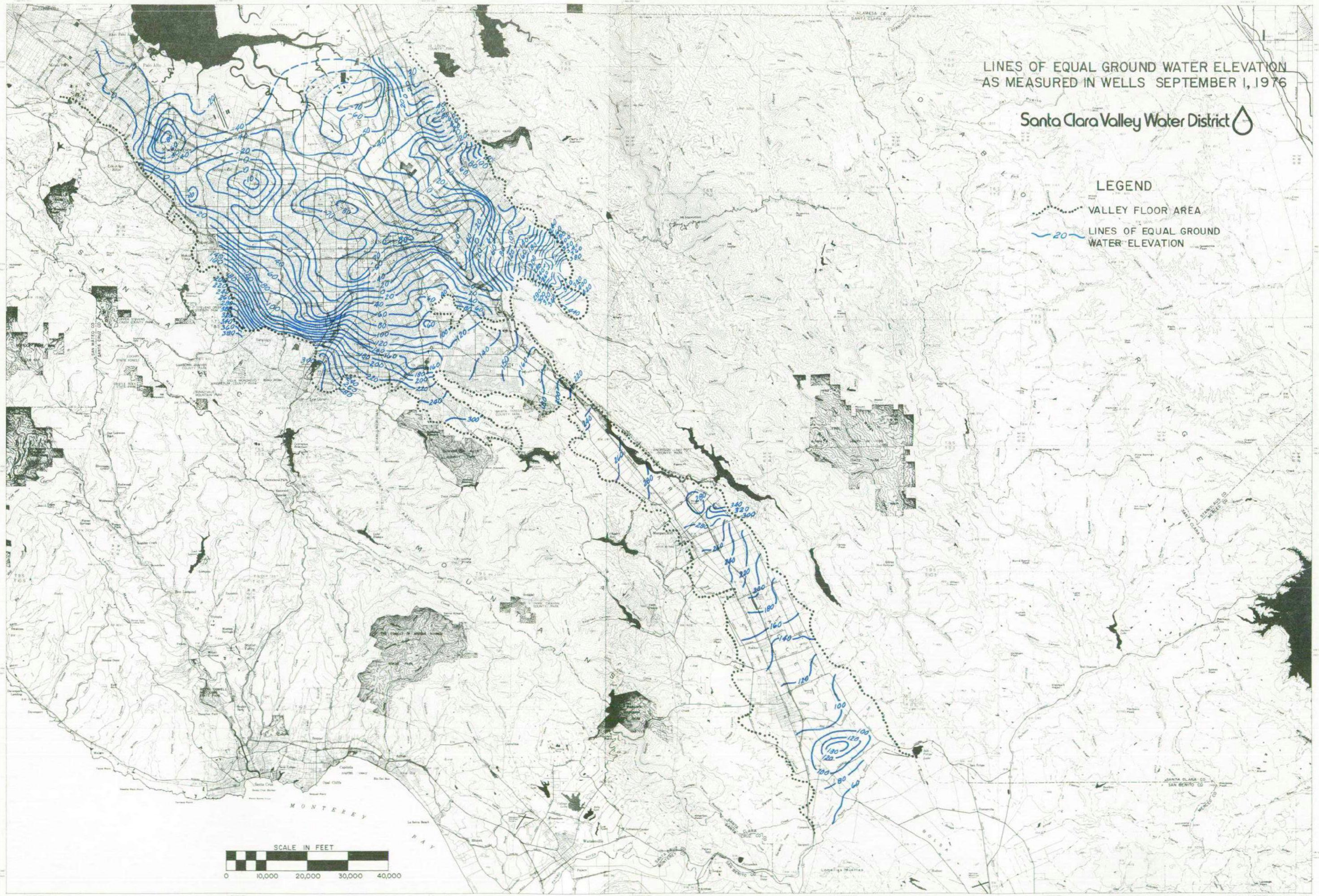
Total Dissolved Solids (TDS) - The quantity of minerals (salts) in solution in water, usually expressed in milligrams per liter.

Water Table - The surface where groundwater is encountered in a well in an unconfined aquifer.



GROUND WATER BASINS
AND
WATER ZONES
Santa Clara Valley Water District
LEGEND
VALLEY FLOOR AREA
ZONE W-2
ZONE W-3
ZONE W-4
8S1E-4M1 WATER QUALITY WELL NO. & LOCATION
PRECIPITATION STATION
6S2W-9Q2
6S1W-12M02
6S1W-14E01
6S2W-20N1
SANTA CLARA VALLEY GROUND WATER BASIN
7S1E-9D2
7S2W-13C1
8S1E-4M1
COYOTE GROUND WATER BASIN
9S3E-28A
10S4E-28D2
LLAGAS GROUND WATER BASIN
MONTEREY BAY
SCALE IN FEET
0
10,000
20,000
30,000
40,000

PLATE I



LINES OF EQUAL GROUND WATER ELEVATION
AS MEASURED IN WELLS SEPTEMBER 1, 1976

Santa Clara Valley Water District

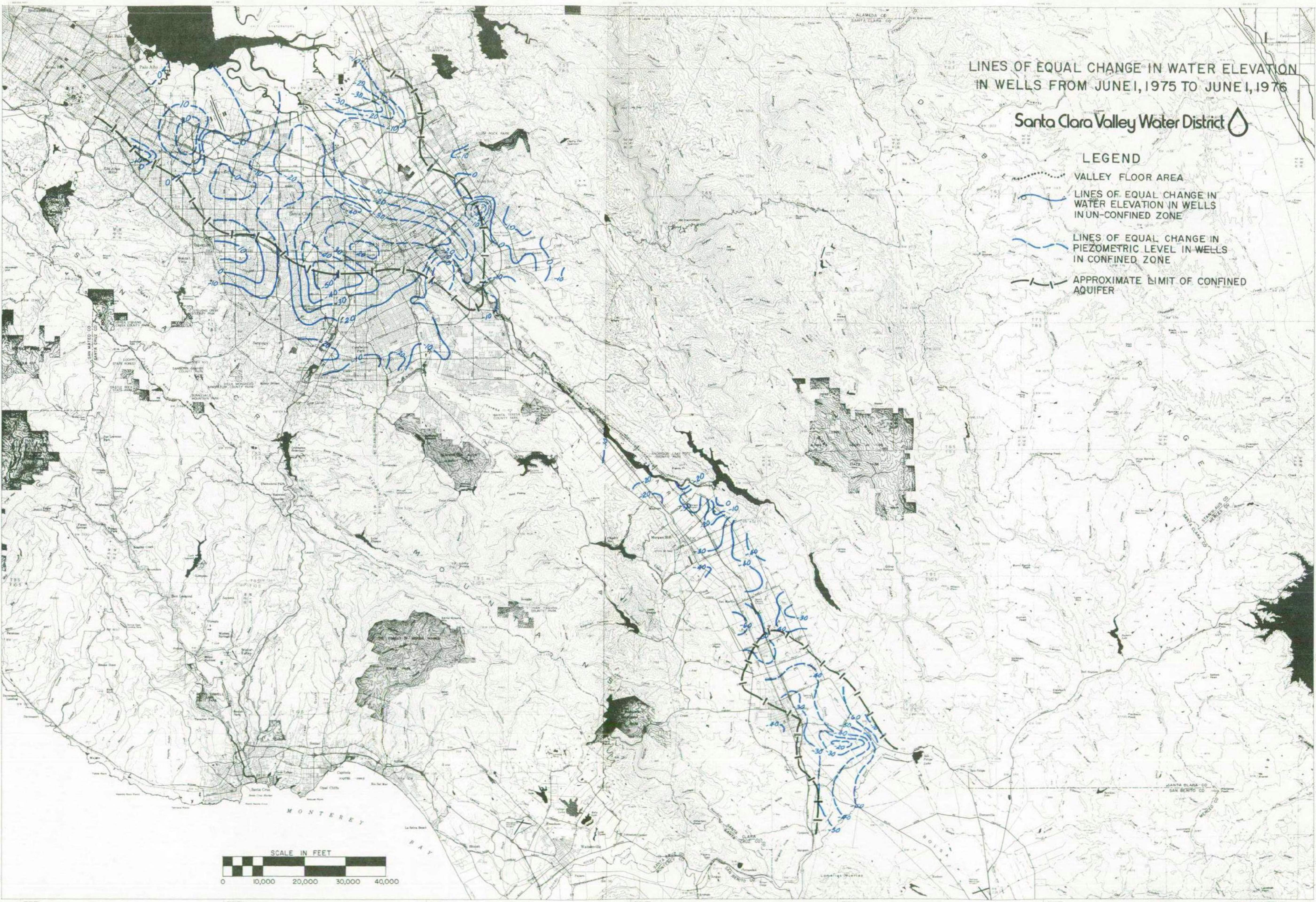
LEGEND

VALLEY FLOOR AREA

~20~ LINES OF EQUAL GROUND WATER ELEVATION

PLATE 2

PLATE 3

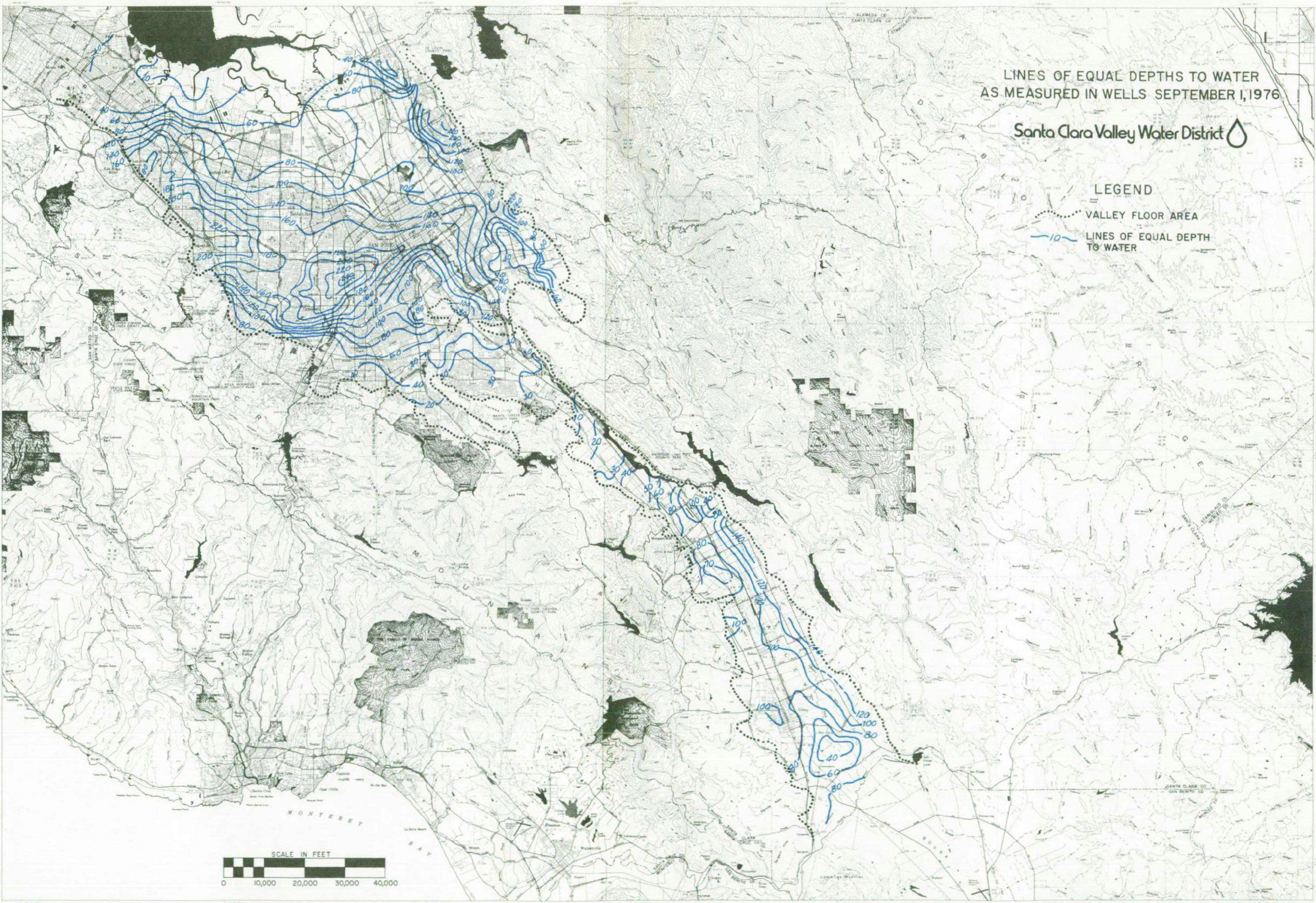


LINES OF EQUAL CHANGE IN WATER ELEVATION IN WELLS FROM JUNE 1, 1975 TO JUNE 1, 1976

Santa Clara Valley Water District

LEGEND

- VALLEY FLOOR AREA
- LINES OF EQUAL CHANGE IN WATER ELEVATION IN WELLS IN UN-CONFINED ZONE
- LINES OF EQUAL CHANGE IN PIEZOMETRIC LEVEL IN WELLS IN CONFINED ZONE
- APPROXIMATE LIMIT OF CONFINED AQUIFER

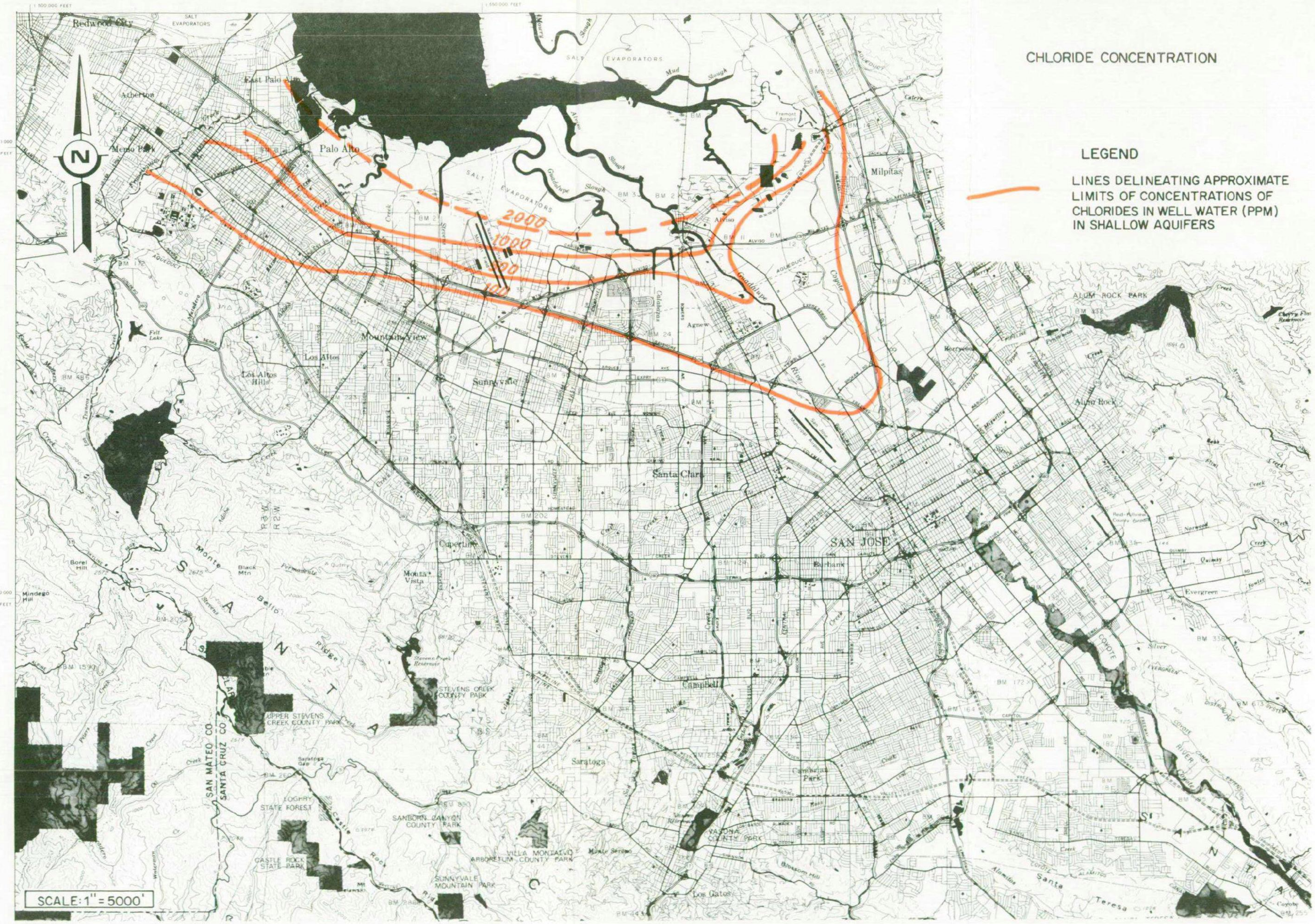


LINES OF EQUAL DEPTHS TO WATER
AS MEASURED IN WELLS SEPTEMBER 1, 1976

Santa Clara Valley Water District

PLATE 4

CHLORIDE CONCENTRATION



LEGEND

— LINES DELINEATING APPROXIMATE LIMITS OF CONCENTRATIONS OF CHLORIDES IN WELL WATER (PPM) IN SHALLOW AQUIFERS

PLATE 5